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Review of "Monitoring Strategies for Chemicals of Emerging Concern in Recycled Water"

1. **Sufficiency of potential water contaminant lists of CECs.**

The approach described in Section 2 of the report for selection of the Universe of CECs builds upon a procedure developed by the EPA in consultation with the National Research Council, and appears reasonable, tailored to issues involving the use of recycled water in California, and scientifically justified.

2. **Appropriateness of the approach for selecting CECs of toxicological relevance to monitor for recycled water uses.**

The approach described in Sections 4 and 5 of the report for selecting CECs of toxicological relevance builds on published approaches (specifically that described in Snyder et al., 2010), and is clear, logical, and scientifically justified. Several minor considerations include: (1) ADIs are variously defined as "allowable daily intakes" and "acceptable daily intakes" (page 30); (2) Relative to Fig. 4.2, "SF" is not defined in the report glossary; (3) The discussion of swimming ingestion rates on page 33 seems out of place. Perhaps the authors should stick to the discussion of the more relevant Cooper and Oliveri, 1998; Sakaji et al., 1998; and Ottoson and Stenstrom, 2003 studies; (4) it would be helpful to know more about the survey instrument employed to obtain information on the CEC monitoring data, and more specifics on the response rate (page 37). In the absence of such information, one might be concerned that the results are not representative; (5) Figure 5.1, please include units on the vertical axis.

3. **Determination of initial MTLs for the landscape irrigation.**

The reliance on Cooper and Oliveieri (1998), Sakaji et al. (1998) and Ottoson and Stenstrom (2003) seems reasonable. Although as noted above, the discussion of swimming ingestion rates appears out of place and irrelevant to this discussion (page 33).

4. **Adequacy of the selected performance indicator CECs**

Section 8.3 is written clearly, and the basis for distinguishing between indicators and surrogates well described. The basis for selecting specific indicator CECs (Table 8.2) could have be better articulated. Also, the symbols delX and delY need to be defined in the text. I gather delX represents the removal of surrogates, while delY represents removal of indicators, but this was not clear.

5. **Adequacy of the selected surrogates for monitoring treatment process performance.**

The selection process adopted for the surrogates and indicators listed in Table 8.2 are not well justified, nor referenced relative to other sections of the report, nor the peer-

reviewed literature. This may be an adequate list, but the process by which it was selected is not clear to this reviewer.

6. **Validity of expected percent removal of surrogates and performance indicator CECs for a treatment process.**

The expected indicator and surrogate removal rates in Table 8.2 are referenced to Drewes et al., 2008, but not described (or more importantly justified) in the text.

7. **Appropriateness of tiered risk quotient thresholds and corresponding degree of response for evaluating monitoring results for health-based CECs in recycled water.**

Perhaps this is inevitable given the qualitative nature of such recommendations, but it is not clear how very specific metrics (such as "no more than 25 percent of the samples during phase-2 monitoring exceed a MEC/MTL ratio of 0.1") were arrived at. What if 25% of samples have a MEC/MTL much great than 1? Wouldn't that be of concern? Perhaps some tangible examples involving real monitoring data (with some cumulative probability distributions shown) would help make these thresholds seem less arbitrary.

8. **Adequacy of monitoring frequencies for CECs and surrogates and the phased monitoring approach.**

Ideally, monitoring frequency would be based on a detailed understanding of the temporal variability associated with surrogates, indicators, and CECs. The report does not provide an analysis of such data (nor does it reference peer-reviewed publications where such analysis was carried out), and as such the recommended sampling frequencies, and phasing approach, seem ad hoc. Again, this reviewer would have benefited from seeing examples of where the variability associated with real data were used to illustrate the efficacy of the proposed approach. A minor comment: please define IPR (presumably indirect potable reuse) in the text (on page 68) and in the glossary.

9. **Additional consideration for the peer reviews.**

Not being a toxicologist, I cannot evaluate the relative merits/demerits of the alternative approach described in Section 4.3. However, as an interested non-expert, I found the section well written and compelling.

<u>The Big Picture</u>

a) In reading the Panel's report and the proposed implementation language, are there any additional scientific issues that are part of the scientific basis of the proposed rule not described above?

Overall, the report is well written, and the recommendations seem sound and well justified. As a minor point, I found the Case Examples (Appendix F) superficial. They read like PR material, as opposed to a balanced scientific evaluation of the performance (both good and bad) of each wastewater reuse scenario. There is also little discussion of unintentional reuse (where treated wastewater discharged to a river, for example, finds its way into a drinking water distribution system). Unintentional reuse is likely a common occurrence (and probably will become more common with time in California as climate change reduces base flows in rivers), and thus intentional reuse projects should be evaluated in that context. A very good discussion of this issue appears in the latest NRC report (published in 2012) on wastewater reuse, which I notice is NOT cited in the Advisory Panel Report.

b) Taken as a whole is the scientific portion of the proposed rule based on sound scientific knowledge methods and practices?

Apart from the specific issues raised above, I believe the report is scientifically sound, and relies on current knowledge of methods and practices.

c) In reviewing the proposed Attachement A (draft amendment), does the proposed language adequately characterize and implement the Panel's recommendations for monitoring of CECs for recycled water use in groundwater recharge and landscape irrigation?

Attachment A appears to adequately summarize the recommendations of the Science Advisory Panel.